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Foreign Agriculture

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crop. Note the increases in 1947 over the 1935–39 average for wheat production in the United States, China, and Australia. The other countries shown produced much less, or just about held their own, in 1947 as compared with the average period. The total 1947 world crop of wheat was approximately 223,000,000 bushels smaller than the average annual production during 1935–39.

Foreign Agriculture

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FRONT COVER

Farm Scene in Colombia

On such rather remote, but well-to-do, farms, the international movement of foodstuffs has little effect.

BACK COVER

World Map—Production of Principal Grains and Soybeans

The total production of the bread grains (wheat and rye), the coarse grains (corn, oats, and barley), rice, and soybeans amounted to about 597 million long tons in the prewar period 1935–39, compared with an estimated total of 564 million tons in 1947. The only commodities of this group showing a total increase in 1947 over the prewar period were corn and soybeans.

Our indebtedness for illustrative material is gratefully acknowledged as follows: Netherlands Embassy, p. 50; British Information Services, pp. 52–53; FAO, pp. 60–61.

NEW NOTES

OFAR'S Fruit and Cotton Specialists Home From Europe

Fred A. Motz and *P. K. Norris*, who were assigned to study market opportunities for fresh fruit and cotton, respectively, in European countries, under the Research and Marketing Act of 1946, have returned to this country. Mr. Motz has more recently been on the west coast, where he addressed several meetings of fruit associations and conferred with various persons engaged in the fruit industry. He also addressed the American Pomological Society in St. Louis, Mo., during February. Mr. Norris, since his return, attended the tenth annual meeting of the National Cotton Council in Atlanta, Ga., and addressed the annual meeting of the Texas Cooperative Ginners at San Antonio, Tex., on February 9, and the Association of Southern Agricultural Workers in Washington, D. C., February 13.

Glen Taggart in El Salvador

Glen L. Taggart, of the Extension and Training Division, Technical Collaboration Branch, OFAR, left for El Salvador on February 2. During a brief assignment in that country, he will work with the technicians at the Centro Nacional de Agronomía and confer with Salvadorans generally in order to complete a social and economic survey of the Colon-La Libertad area undertaken on an earlier visit.

Head of P. M. A.'s Potato Division goes to Europe

Alfred E. Mercker, Chief, Potato Division, Fruit and Vegetable Branch, P. M. A., USDA, left Washington in early February to study, in particular, the market for seed potatoes in western Europe, a special assignment under the Research and Marketing Act.

FOREIGN AGRICULTURE HALLY H. CONRAD, EDITOR

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International Movement of Foodstuffs

by **R. L. HARRISON**

A conversation I had 2 years ago in China with Dr. T. H. Shen, an agriculturist at the agricultural experiment station outside Peiping, illustrates one method of attacking food problems.

In the course of investigating Chinese postwar food problems, I asked Dr. Shen whether, in a country as large as China proper (south of the Great Wall and excluding Inner and Outer Mongolia and Tibet), there is ever a year when crops do not fail in some area.

Dr. Shen answered that somewhere in China there are crop failures of varying degree every year, and I asked how, in view of insufficient communication, transportation, and other facilities, China could move enough food to prevent starvation in these areas.

Dr. Shen replied: "The people migrate to the food."

He then showed me a map of the historic routes that migrants have taken in China when food shortages or famines occur in the various producing areas. The map showed that when famine strikes in Honan Province, some of the people go to Shensi, others to Shantung, some to Hupeh, and some all the way to Szechwan. Similarly, when famine strikes in Hunan Province, some of the people migrate to Hupeh Province, some to Kwangsi, some to Kweichow, and others to Kiangsi.

This Chinese response to a very difficult problem would hardly be usable in the world as a whole. We have to take the food to the people.

The counterpart of Dr. Shen's map of the Chinese people's hunger-migration routes is perhaps the pair of maps presented with this article. They show the changed "routes of migration" in the international movement of a group of most important famine-fighting foods—the grains, including rice and soybeans. The tremendous change from prewar years to the present illustrates the enormous efforts which this country, among others, has been called upon to make to meet the food crisis. If the changes in world movement of these important commodities persist, they hold highly significant implications for the agriculture of the world.

Col. R. L. Harrison is Special Assistant to the Secretary of Agriculture on World Food Problems.

During the period of hostilities in both World Wars I and II, we had a world shortage of food. But food production recovered quickly after World War I, and in a short time there were actually food surpluses, particularly of grains, that eventually became burdensome in many countries.

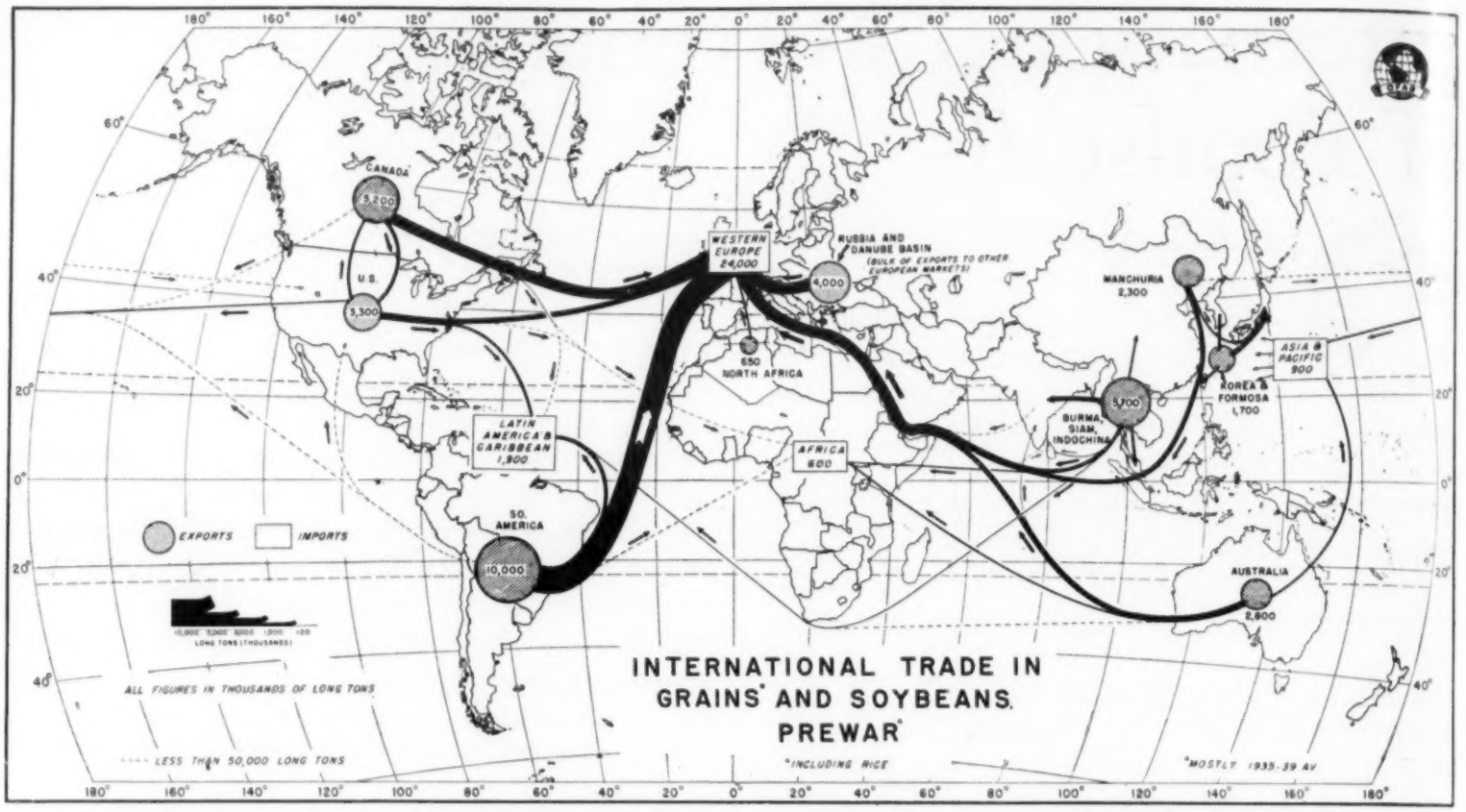
Probably most agricultural economists expected a similar development after World War II. To date no such condition is even in sight. The current outlook is for a world shortage of food, particularly of cereals, for some years to come. The situation is much too complicated to come under the generalization contained in the usual broad statement—"It's because of the war."

In addition to the problems of crop collections, transportation, storage, processing, and so on, created by this immense change in "food migration routes," the very complicated question is raised of how the recipients will pay for their food. Temporarily, they have to have dollar loans to pay for food imports. Eventually they will have to pay for them with services, tourist trade, and exports of goods and raw materials.

The last mentioned will require substantial increases in industrial production for export in all food-importing countries. This, in turn, will require raw materials, fuel, and petroleum products. It will also require that food-exporting countries buy the products of food-importing nations. It will be a long time before all the problems incident to balancing trade between food-exporting and food-importing nations are solved, but over a period of years they must, of course, be solved.

As the first map (prewar) shows, before the war there were large movements of grains and soybeans within the Asiatic and European areas themselves. The movement of cereals from the Americas to the Asiatic areas was negligible. Asia and Australia sent considerable quantities of these products to Europe. Most of the Western Hemisphere stream to Europe arose in South America.

But the postwar map (1946–47) shows an entirely different situation. The movement of these important foods from eastern into western Europe has ceased;



Before the war the main flow of international trade in foodstuffs was from South America to Europe.

in fact, North America helped supply eastern Europe in 1946–47. Movement of these foods within the Asiatic area has almost ceased, and greatly increased quantities have had to be pumped, chiefly from North America, into Asia. The stream of such foods moving in international trade from South America has greatly diminished.

As an example, shipments of rice in the calendar year 1947 from the surplus areas in southeast Asia (Indochina, Siam, Burma), totaled about 1,300,000 long tons [1] of milled rice. Before the war, this area exported an average of 5,800,000 tons, mostly to India and China, with some shipments to France and other European countries.

Before the war, Manchuria exported annually about 86 million bushels of soybeans, largely to Europe and Japan. In the calendar year 1947, the surplus from this area, if there was a surplus, did not enter world trade channels but was retained in Manchuria or went to Soviet Russia. Neither Formosa nor Korea, formerly surplus-food-production areas, exported any food, whereas South Korea actually imported grain from the United States.

Japan—a country where the United States currently has a considerable responsibility—has been for many years a food-importing nation. In the 1936–40 period, Japan annually imported, mainly from Korea, Manchuria, and Formosa, food equivalent to 4 million tons of polished rice to help feed a population about 8 million smaller than at present.

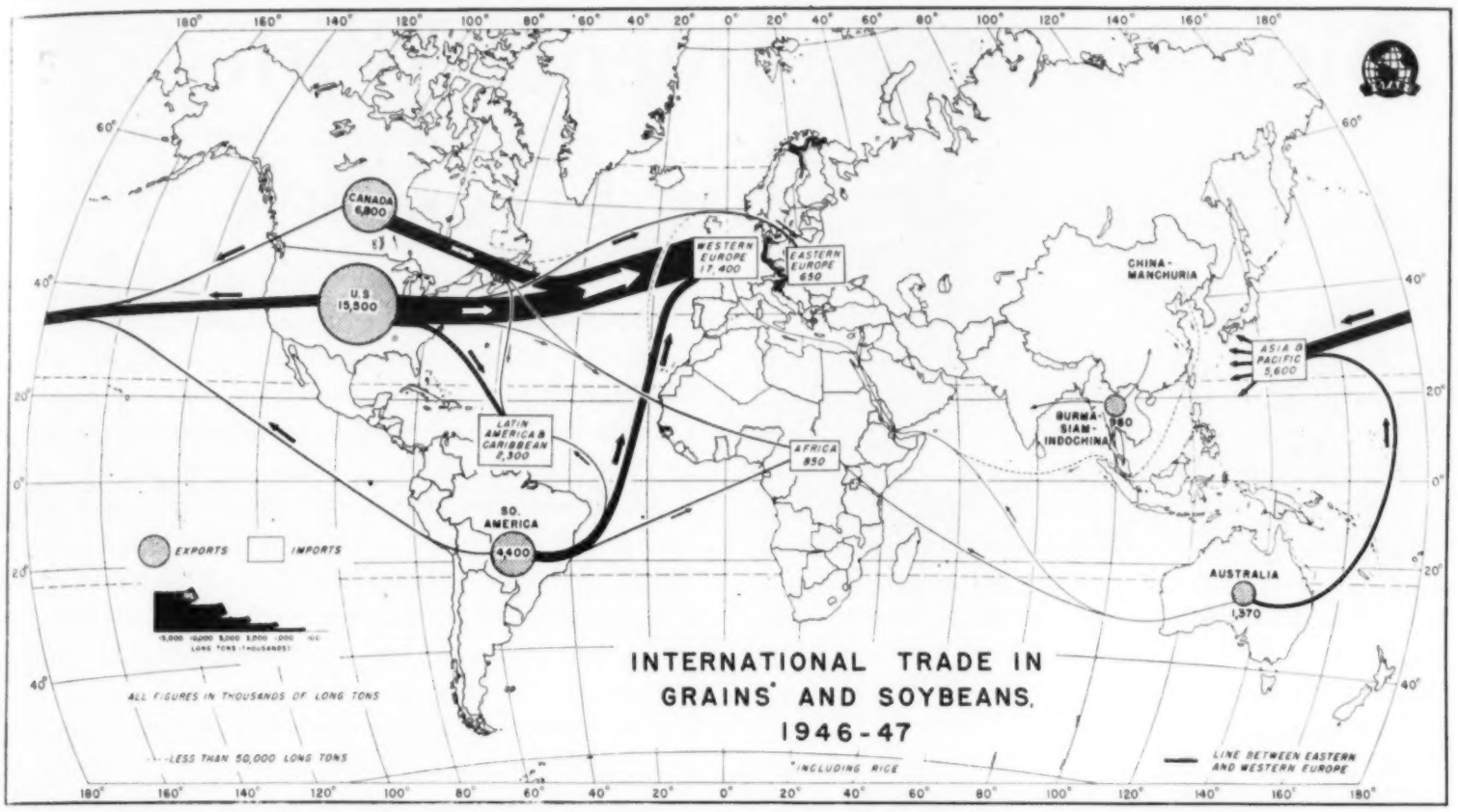
Since the surrender of Japan in 1945 there have been no food imports of consequence from the three areas named or other nearby areas. The United States has supplied practically all the supplementary food Japan has received since VJ-day. These shipments totaled about 700,000 tons in the fiscal year 1945–46; they will reach about 1,500,000 tons in 1946–47 and as much, or more, in 1947–48.

As in Asia, European food production has not reached its prewar level. Flow of food from prewar surplus-producing eastern and southeastern European areas is insignificant. Whether the prewar flow of surplus food will be reestablished from these areas and Manchuria, now within the zone of Soviet occupation or influence, cannot yet be determined.

There is no significant movement of food from eastern Germany (the Soviet zone) into western Germany (the United States, British, and French zones). While prewar Germany was 83 percent self-sufficient in food, western Germany was even then only about 60 percent self-sufficient; and in 1946–47, with 13 percent more population than before the war (1936), western Germany was only about 70 percent self-sufficient, even with per capita consumption reduced by more than one-fourth, compared with prewar.

To restore the food intake of people in western

[1] 1 long ton equals 1.12 short tons.



In 1946–47 the source of the predominant flow of trade in foodstuffs had shifted to North America.

Europe and the Orient to approximately prewar levels, food production will have to be expanded in all areas capable of expansion. The need will be reduced as greater supplies become available from eastern Europe and if food is obtained from Manchuria.

The drain on the food resources of the United States and Canada is particularly heavy because of the decrease in exports from the Argentine to about 40 percent of the prewar volume. The decrease in exports from Argentina and Australia this past season totaled over 7 million tons of grain that had to be made up by increased exports from other countries.

In order to help meet this situation, the United States Congress recently empowered the Secretary of Agriculture, through the Commodity Credit Corporation, to stimulate and expand non-European foreign-food production (sec. 7, Public Law No. 395, approved December 30, 1947).

Discussing this provision recently with the Policy Committee on Production and Distribution of the Council of the Food and Agriculture Organization, Secretary of Agriculture Anderson said—

> The methods by which we are authorized to proceed fall into three categories. We can provide technical assistance; we can furnish requisites of production; we can proceed by "procurement, the making of advances and price guaranties."

Secretary Anderson also pointed out that the necessity for rapidly increasing food supplies concentrates attention under this program upon a few commodities—in general the lower cost staple foods—and upon a few areas where arrangements for increased surplus production for export might most quickly be made. In general, he said, such areas are those where the products have customarily been produced in quantity for export.

Under these conditions, Secretary Anderson said that "our present thought is of technical assistance, where useful and desired, in connection with specific short-term problems of production, processing, storage or shipping," rather than in connection with long-term programs of expanding agriculture.

As for the furnishing of requisites of production, he referred to the increased copra production in the Philippine Islands resulting from bringing in inter-island boats, trucks, and trade goods, as an example of what might be accomplished.

Emphasizing that the section referred to is part of an anti-inflation measure, Secretary Anderson said—

> In keeping with this purpose our procurement operations should serve to stimulate production. We would not feel justified in merely paying higher prices for what is, or would be, produced anyhow.

For these reasons, Secretary Anderson stated—

> It has seemed to us that our approach might be to offer to negotiate directly with governments in position to cooperate. Arrangements might refer to specific quantities of particular commodities, and provide in definite terms for procurement, for useful and desired technical assistance, and for furnishing of available and necessary requisites of production.

Colombia Experiments With Credit in Kind for Livestock

by **KENNETH WERNIMONT**

If a farmer in the Department of Antioquia, Colombia, has a tract of land suitable for cattle raising but lacks the capital with which to buy the cattle, he may borrow the animals from the Antioquian Cattle Fund, Inc. This unique corporation, organized July 19, 1941, now has "on deposit" 46,000 head of cattle valued at over a million dollars. They are located on 383 farms scattered throughout the Department and serve for mutual profit of farmers and the corporation (table 1).

The idea of maintaining a fund of cattle was formulated in Antioquia State-government circles in 1940. When it soon became apparent that the plan could be more easily administered by a public organization than by the usual government bureaus, the corporation was formed, capitalized at 1,001,200 pesos (about $571,000), some two-thirds of which amount was subscribed by the State government, about 300,000 pesos by the Antioquian Railways, and 1,201 pesos by the individuals who founded the corporation. By 1946 the authorized capital was almost trebled, and the amount subscribed by borrowers reached almost 12,000 pesos.

The system of lending employed by the corporation is relatively simple. The prospective borrower makes application to the Fund headquarters in Medellín.

Because of inadequate transportation, cattle in Colombia often travel long distances afoot, over winding mountain roads, to reach a market.

He states the number of cattle he desires to borrow, the type of pasture and kind of care that he is in position to provide, the exact location of his farm, and the names of several persons for reference purposes. This application is studied by the Board of Directors at one of its weekly meetings. If favorable decision is reached, an inspector is sent to look over the farm. If his report is satisfactory, the necessary cattle are purchased, at either public or private sale, and the cattle are delivered to the farmer. He signs a receipt based on the number, type, and value of the cattle borrowed.

Table 1.—Number of cattle per borrower loaned by Antioquian Cattle Fund, Inc., as of Jan. 1, 1947

Number of cattle	Borrowers	
From—	*Number*	*Percent*
5 up to 50	157	40.99
50 up to 100	94	24.54
100 up to 150	43	11.22
150 up to 200	34	8.88
200 up to 250	16	4.18
250 up to 300	8	2.08
300 up to 350	11	2.89
350 up to 400	4	1.04
400 up to 450	2	.54
450 up to 500	3	.78
500 up to 550	4	1.04
550 up to 600	1	.26
600 up to 650	2	.52
650 up to 700		
700 up to 750	1	.26
750 up to 800	2	.52
1,050 up to 1,100	1	.26
	383	100.00

The Fund then enters into a contract with the borrower. The farmer agrees to care for the cattle properly on the farm described in the original application; to provide satisfactory pasture, and salt at least every 15 days; and to give the usual attention to weaning, castration, control of "nuche" and ticks, and the prompt treatment of diseases.

The borrower also agrees to the following: (a) Not to milk cows belonging to the Fund, since it is desired that calves have the full advantage of the milk; (b) to vaccinate cattle against anthrax and to vaccinate calves as they are born, as well as to carry out any other vaccination ordered by the Fund; (c) to make the cattle available for inspection by the Fund; (d) to report to the Fund once a month on the condition of the cattle and the number of deaths and births occurring during the preceding month; and (f) to brand the cattle in accordance with the laws applying to brands, or to pay a fine to the Fund. Expenses of delivering the cattle to the farm, or for selling them; commissions for buying and selling; and such items as telegrams, freight charges, and vaccines are for the account of the Fund but are considered as additions to the value of the cattle.

A group of Romo-Sinuano cattle, one of the better breeds raised in Colombia.

At the end of each year, loans are "liquidated." If the Fund so desires, the cattle may be sold. Or a borrower may continue to retain all, or part, of the cattle for another year under the terms of a newly signed contract. At the annual "liquidation," or in case of sales of cattle by the Fund during the year, the Fund pays the borrower 75 percent of the net profits. The profit is determined by subtracting the original cost, or appraised value, together with administrative charges, from the final sale price or the appraised value of the cattle at the end of the year. The contract specifies that in case a loss accrues instead of a profit, the borrower loses only the cost of salt and pasture and such other amounts that he may have invested in the cattle during the year, provided he has not failed to carry out his part of the contract.

How a Loan Works

As an illustration of the manner in which the loans work out in practice, a farmer from the vicinity of Dabeiba in the northwestern part of the State, borrowed 83 head of cattle from the Fund on April 14, 1946. As of the date of the loan, these cattle were valued at 3,938.50 pesos. Administrative expenses paid out by the Fund amounted to 12.07 pesos, which increased the principal of the loan to 3,950.57 pesos.

The loan was liquidated on April 7, 1947, at which time the borrowed herd comprised 98 head of cattle with an appraised value of 5,355 pesos. The Fund

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Sr. Alberto Angel, president of the Antioquian Cattle Fund, Inc.

had sold 2 head during the year for 120 pesos, by which amount the total value was increased to 5,475 pesos. This represented a net gain over the original loan value of 1,524 pesos.

The Fund paid to the farmer 1,143 pesos in cash and considered as its own gain 381 pesos, or 9.6 percent on the original investment. The farmer then renewed his loan under a new contract that covered the 98 head of cattle which were on his farm on the date of the new contract, and the principal of the new loan was 5,475 pesos, or the appraised value of the cattle in April 1947.

Much of the success of the Cattle Fund, Inc., to date may be attributed to its manager, Sr. Alberto Angel. In 1943, the board of directors drafted him to serve as president of the corporation on a temporary, emergency basis. He is still on the job.

Sr. Angel is a cattle rancher by profession. He knows cattle and he knows the farmers who borrow from the Fund. He also knows how to pick men who know cattle to serve as appraisers and inspectors.

The staff of the Fund is small, numbering five inspectors and six other employees, including the manager. Overhead costs are kept to a minimum. Nevertheless, each operation is carried out in an orderly and businesslike manner, with complete monthly records being kept of what happens in each borrowed herd.

Mutual confidence is the keynote of the experiment in providing credit in kind for the livestock farmers of Antioquia. It may well become the pattern for livestock credit throughout the country.

Reading about... Foreign Agriculture

Report of the Philippine-United States Agricultural Mission, I. A. C. Series, No. 3., OFAR, USDA. 50 pp., illus., Washington, D. C., June 1947. The United States, by invitation of the Philippine Government, sent a mission to the Philippine Islands in the summer of 1946 to further the program of cooperation and collaboration in agriculture undertaken by the two countries. The United States section was headed by Dr. Leland E. Call, dean, College of Agriculture, and director, Agricultural Experiment Station, Kansas State College. Upon completion of their work, the United States members made this report, which contains the mission's observations and recommendations as developed in conferences and consultation with the Filipino members.

Forward Prices for Agriculture, by D. Gale Johnson. 259 pp., illus. University of Chicago Press, Chicago, Ill., 1947. This book is devoted to an exploration of the advantages and limitations of a particular price policy for agriculture—forward prices—and of the supplementary conditions required to make such a policy operate successfully. It compares the advantages of assuring farm prices in advance with other theoretical or tried methods of farm price support. The author believes that reducing price uncertainty would result in a more efficient utilization of the resources which are available to agriculture.

Both the theoretical and practical problems of storage, price determination, and supplementary payments—all essentials of a forward pricing system—are discussed in detail.

Report of the United States-Syria Agricultural Mission, I. A. C. Series, No. 4, OFAR, USDA. 99 pp., illus., Washington, D. C., September 1947. In response to requests of the Syrian Government for assistance with agricultural problems and development, the United States Government sent a mission to Syria, consisting of three members—Dr. Franklin Harris, president of Utah State Agricultural College; Dr. Robert Earle Buchanan, director of Iowa State Agricultural Experiment Station and dean of Iowa State College of Agriculture and Mechanic Arts; and Dr. Afif Tannous, rural sociologist, Office of Foreign Agricultural Relations. After extensive travels throughout the country, conferences with agricultural authorities, and meetings with farmers and tribal groups, the mission made this report.

European Programs for Expanding Agriculture in Overseas Territories

European countries [1] having overseas territories are making efforts to expand food production in them. Such efforts tie in with their programs for expanding and increasing the productivity of the agricultural plant in the homeland. For the overseas territories, the plans tend to emphasize the particular crops to which an area is believed to be best suited, or the production of which seems capable of being expanded rather rapidly by large scale development.

The measures embodied in these plans include irrigation and drainage, clearing of jungle or bush, establishment of port and inland transportation facilities. They include also steps to rationalize production, such as experimental and educational work; provision of machinery for large-scale cultivation; and establishment of primary processing facilities in certain centers. They may likewise include programs designed to guarantee certain levels of returns to producers.

Important among the commodities emphasized are vegetable oils, rice, and cocoa. In a number of cases, however, other grains, fruits and vegetables, or dairy and other livestock products are included, in part by way of providing more adequate local food supplies as a means of improving labor supplies and the living conditions of the people.

The welfare of local populations usually receives particular attention in these development programs. Clearing and drainage are prerequisites, in some cases, to control of disease-carrying insects and other pests. Domestic water supply and sometimes electric power may be associated with irrigation work. Transportation and processing facilities may add significantly to incomes of producers. Health and educational services are usually provided.

Without attempting to evaluate fully the chances for success of projects of these kinds, some of those which have been started or are under consideration are briefly summarized below.

Belgian

Plans to increase production of vegetable oils, such as palm, palm-kernel, and cottonseed, in the Belgian Congo are now being made effective, primarily by commercial interests. The Unilever Co. is expanding port and processing facilities to obtain larger quantities of palm oil, and estimates indicate that the palm-oil output may reach 165,000 short tons in 1948, compared with about 130,000 tons in 1946 and 1947.

As one phase of the peanut-expansion program in Africa, the Unilever Co. has established an experimental tract of 1,250 acres for the production of peanuts in the Eastern Congo.

Crushing plants to utilize cottonseed in the Eastern Congo are under consideration. Four plants are in operation. The annual outturn of cottonseed oil, negligible until a few years ago, is increasing.

French

The French 4-year modernization and reconstruction plan covers overseas possessions as well as the homeland in Europe. A law of April 30, 1946, also provided for the drawing up of 10-year plans for the

Larger quantities of palm oil are expected to be obtained in the Belgian Congo from the African oilpalm.

[1] This summary of overseas-territory agricultural programs of some of the European colonial powers complements FOREIGN AGRICULTURE's February article on the home-territory programs of European countries. Principal authors were Montell Ogdon, Lois Bacon, and Mary E. Long, Regional Investigations Branch, and Russell S. Kifer, International Commodities Branch, OFAR.

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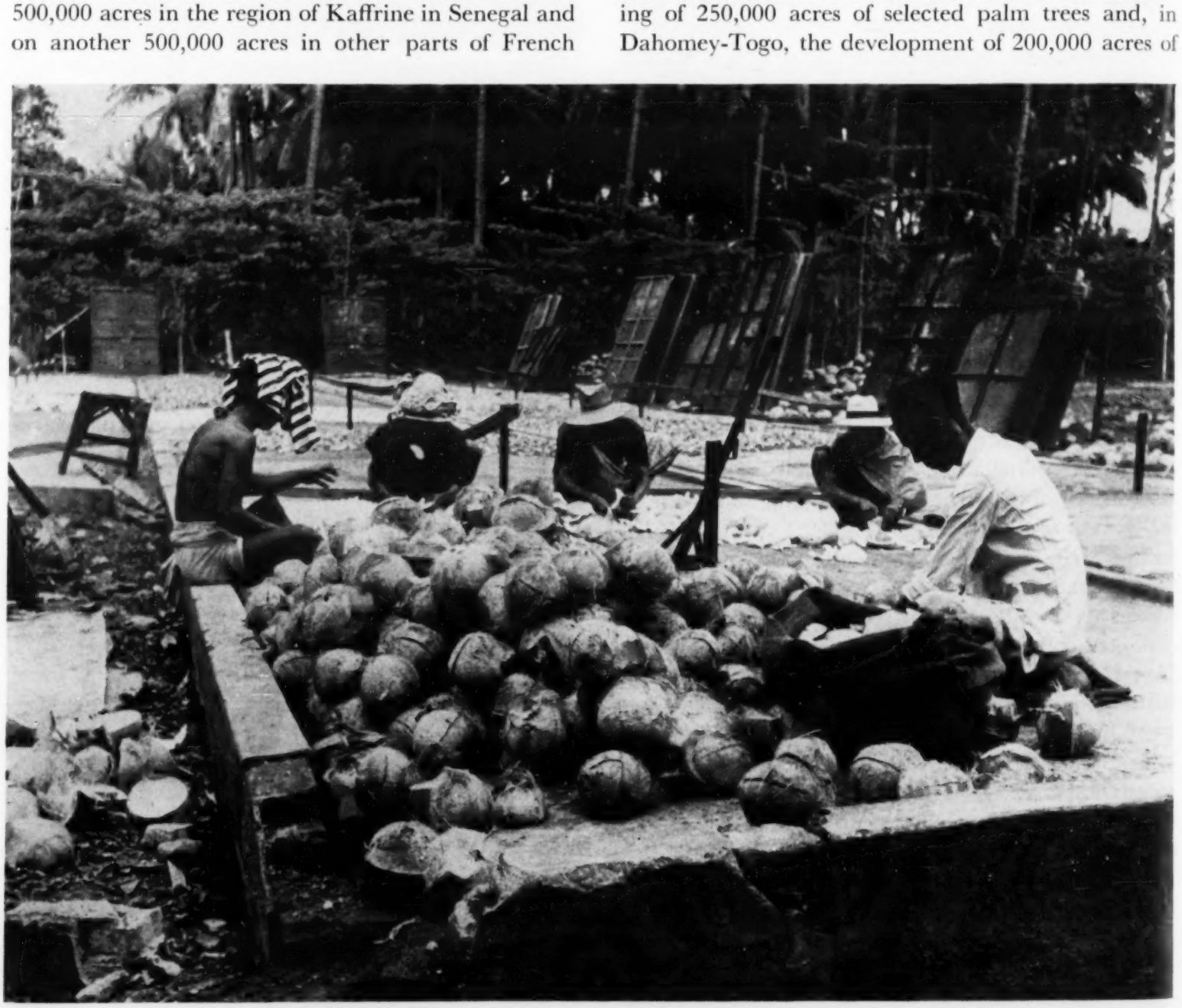
economic and social development of overseas possessions, designed to improve the lot of the native populations and to contribute to the execution of the over-all plan for the French Empire or Union.

Among the 10-year plans drawn up, that for Madagascar includes, along with other projects, the development of the basin of Lake Alaotra (250,000 acres), improvement of the delta of the Mangoky and the valley of the Ankaizina (430,000 acres), irrigation and drainage of numerous plains (250,000 acres in total), and the equipping of agricultural, forestry, and veterinary services; that is, with testing stations, schools, and laboratories.

In the French colonies of Central Africa, in order to increase the output of peanuts quickly, it is proposed to mechanize cultivation, employing wage labor, on 500,000 acres in the region of Kaffrine in Senegal and on another 500,000 acres in other parts of French West Africa, in French Equatorial Africa, and in the Cameroons.

A further proposal is to develop cooperatives for the semimechanized cultivation of peanuts by native growers in the same colonies. Peanut production likewise is to be stimulated by providing incentive goods and by freeing growers from the necessity of producing all their own food through the irrigation of 680,000 acres for rice production. Planned rice production from this irrigated area totals 182,000 short tons, of which 110,000 tons will be commercialized, a quantity approximating the 1934–38 annual average rice imports into the area.

As for palm and palm-kernel oil, provision of incentive goods is the major means proposed for restoring production quickly. A 10-year program for the planting of 250,000 acres of selected palm trees and, in Dahomey-Togo, the development of 200,000 acres of



A coconut factory in Java. The nuts are first cracked across the shell; then the meat is cut out and dried, making copra from which coconut oil is extracted.

wild trees, is already under way, but it will not affect production before 1951. Facilities for processing 1,000 to 4,000 tons of palm oil per year were to be installed early in 1948, and the purchase of additional facilities is being considered.

Cocoa beans are also receiving attention in the Ivory Coast, where the Government, alarmed at the drop in output, is actively promoting plans for increasing production. Cleaning of neglected plantations, replacement of useless or diseased trees, establishment of nurseries, and utilization of new areas suitable for cocoa culture are part of the program. Lack of personnel has hampered progress.

Netherlands

In the Netherlands East Indies the Netherlands Government is attempting to restore production of copra and palm oil. Production of copra is expected to attain the prewar level in 1950, and normal production of palm oil may be reached a few years later. Progress on the restoration of the palm-oil plantations depends upon establishment and maintenance of political stability in the plantation areas. The U. S. Commodity Credit Corporation, in an agreement with the Netherlands Indies government, in 1946 advanced $15,000,000 to aid in the rehabilitation of the copra industry. The loan was to be used for the purchase of rice and textiles, for boatbuilding, and other needs. Progress has been slow, and in 1947 Netherlands Indies copra production was only about one-third the prewar volume. The output in 1948 should be considerably larger than in 1947.

British

Various programs have been adopted by the United Kingdom for increasing the production of foodstuffs in British overseas areas, such as British East Africa, British West Africa, the Rhodesias, Nyasaland, Malaya, Solomon Islands, and the British Caribbean region. Particular emphasis has been placed on such crops as cocoa, peanuts, soybeans, wheat, and rice. In furtherance of these plans, however, numerous obstacles have been encountered, among which are shortages of labor and machinery, lack of fertilizers, and inadequate port and railway facilities.

In East and Central Africa, the United Kingdom Government has undertaken a sizable project to increase peanut production as a source of additional supplies of fats and oils. If developed on schedule and as planned, this project would result in the planting of 1,605,000 acres to this crop and the annual production of 672,000 short tons of shelled peanuts by 1952. The plan is to organize production into 107 mechanized units of 30,000 acres each. The British Government is providing £24,000,000 to finance the project and an additional £2,500,000 to develop port facilities from which to handle the products. The actual work of carrying out the plan is directed by the United Africa Co., a subsidiary of the Unilever Co.

Recent reports indicate that progress on this project is behind schedule; only 15,000 of the 150,000 acres that were to be planted for harvest in 1948 are being seeded this season. The entire production from the 15,000 acres will be required for next year's seeding. No peanuts, or peanut oil, are now expected from the project until 1949. Difficulties in obtaining machinery, in clearing bush, and in securing labor have handicapped progress. British Government officials still express hope that the 5-year objective may yet be attained.

Most of the newly cleared area will be located in Tanganyika. The removal of brush and shade—the natural habitat of the tsetse fly (carrier of sleeping sickness)—is expected to provide much of the large acreage, as well as to assure relatively safe conditions for the health of the labor force required to plant and harvest the peanut crop. Other areas to be cultivated are located in Kenya and Northern Rhodesia.

The Nyasaland colonial government has just announced a prospective program of increased agricultural production for export to hard-currency markets. An increased domestic production of wheat, dairy products, edible oils, fruits, and vegetables is contemplated to minimize imports and to provide soybeans for export.

Tanganyika has inaugurated a long-range rehabilitation project for redistribution of population and livestock from depleted-soil districts to newly irrigated areas. In addition to providing ample water supplies, the government hopes to introduce improved methods of husbandry, soil conservation, and agricultural mechanization on a communal basis for about one-fifth of the native population.

The government of Southern Rhodesia is contemplating the development of a large irrigation project and extension of inland navigation by the erection of a dam in the Kariba Gorge of the Zambezi River. The additional water supply provided by this project would make several million acres in the Zambezi Valley below the gorge suitable for cultivation of tropical and subtropical crops.

The Gold Coast's program of increased food production centers around the planting of additional areas to rice, soybeans, and peanuts as an aid to Britain's

food program. New districts are being explored for the expansion of cocoa production, but, according to most reports, new areas suitable for growing cocoa trees in the Gold Coast are not extensive.

A British Groundnut Production Mission has made recommendations as to areas suitable for peanut production in Nigeria. Land in both Bornu Province and in Kantagera district of Niger Province is suited to the mechanized production of peanuts, although the latter district is not so well situated climatically as Bornu. If the projects are approved, the first crops are not expected to be planted before the 1949 season because of the need for inaugurating soil-conservation projects.

The special cocoa programs applicable in several British dependencies should be mentioned in connection with these schemes of expanded production in view of the fact that British West Africa produces about 55 percent of the world supply of cocoa and world prices are based upon those established by West African growers. The Gold Coast Department of Agriculture, in cooperation with the West African Cocoa Research Institute, initiates and finances research programs to combat plant diseases and insect pests harmful to the cocoa industry. Long-term programs, now in effect against the spread of "swollen shoot" disease and capsid bugs, are expected to contribute greatly to the future development of cocoa production in the Gold Coast.

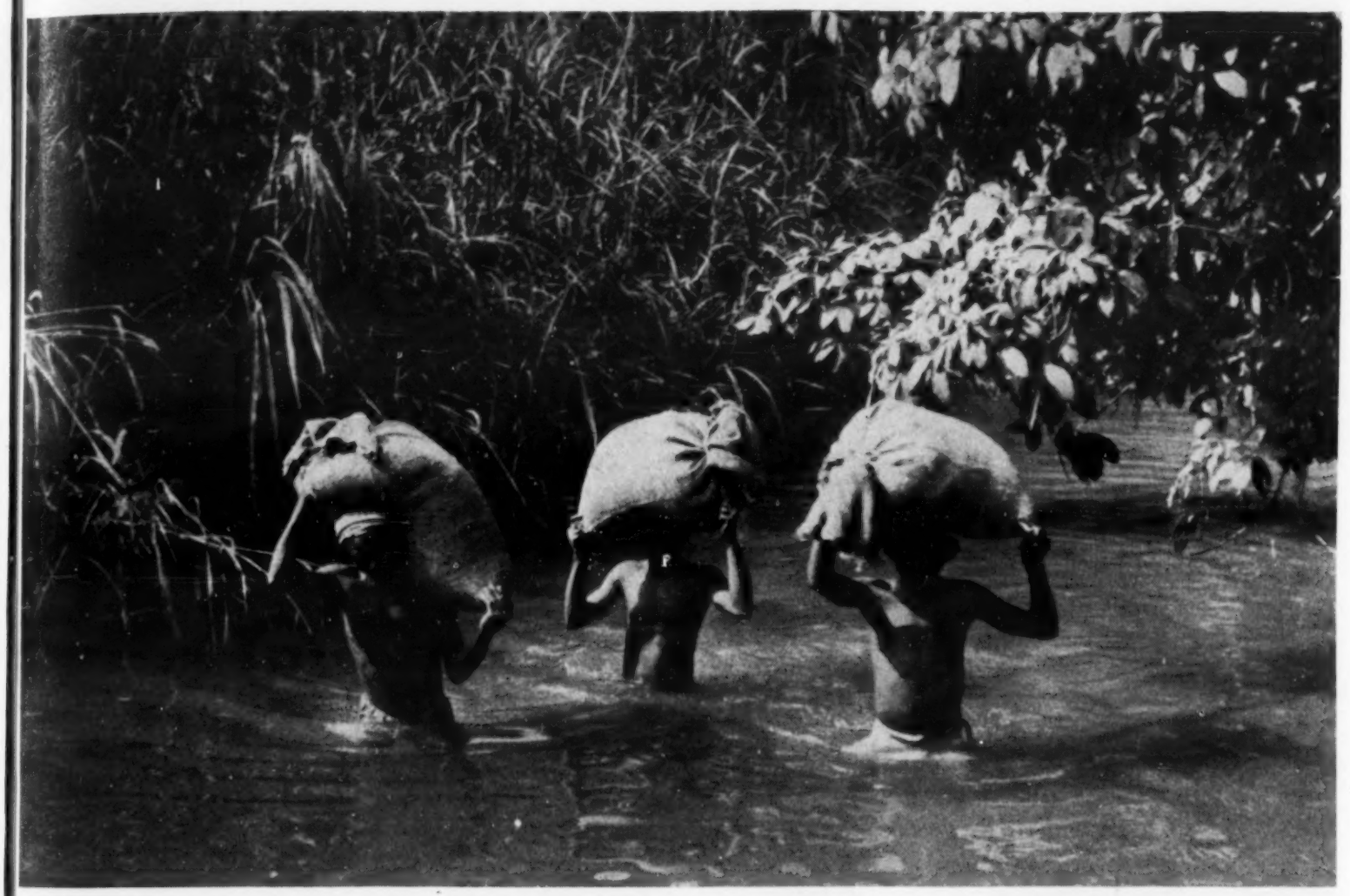
The Gold Coast Cocoa Marketing Board now is solely responsible for the marketing of Gold Coast cocoa and presumably will continue support of the Institute. The Board buys all cocoa for export at fixed prices and arranges for its sale. Profits arising from the Board's operations are to be used for improvement of the cocoa industry.

In mid-1947 the West African Cocoa Research Institute made a survey of the possibility of increasing cocoa-bean production in the British Cameroons. The Institute reported an area of 3,700 square miles that might be rehabilitated so as to become a permanent cocoa-producing region.

Since additional land in Nigeria suitable for cocoa culture is extremely limited, special emphasis is placed on increased production through improved agricultural practices and planting of higher yielding trees. Although cocoa diseases are widespread, "swollen shoot," the most serious, has not become firmly entrenched owing to control measures originating from the joint efforts of the Cocoa Research Institute and the Nigerian Department of Agriculture.

Progress has been made on irrigation and mechanized land-clearance schemes in the Malaya Union. The Malayan government, in cooperation with the Department of Drainage and Irrigation, the Department of Agriculture, the States, and Straits Settlements, has worked out a program involving mechanized cultivation. More than 70,000

Clearing the bush at Kongwa, central Tanganyika. First stage is to cut the surface growth, including, in this case, a large euphorbia, cactuslike plant, found chiefly in arid African regions.



In the Gold Coast, British West Africa, dried cocoa beans are carried from the farms by headloaders, and their journeys are often arduous.

acres of new or previously abandoned rice lands have been brought under irrigated cultivation by these projects, and improvements have been effected which are expected to increase yields upon an additional 120,000 acres.

A colonization scheme, estimated to cost roughly $460,000 is under way, but expenditure of only $34,000 has actually been approved. New settlers are being encouraged to take up lots by offers of inducements in cash and kind. Subsidies varying from $50 to $70 for every 3 acres cleared and planted (dependent upon the thickness of jungle) have been granted, along with distribution of rice seed amounting to 280,000 pounds during 1947. Supplies of agricultural implements either for loan or at moderate prices have been made available. The government has purchased and received 110 tractors from United States Army surplus in Manila.

The Malayan government has made use of the compulsory powers provided in the Land Rules to induce negligent owners to produce more food. By the end of 1946, 35,000 acres or 1.75 percent of estate lands were under the compulsory food-crop-production scheme, which requires that 2 percent of the acreage of estates of 100 acres or more be utilized for such food crops as rice, millet, or corn.

Loans totaling $322,000 for purchase and distribution of manures have been used this year. Authorization for loans to the amount of $48,000 for purchase of buffaloes has been made in districts where there is a shortage; the animals are to be obtained from areas where surpluses exist. The government also has taken steps against pests and diseases.

The British colonial government is endeavoring to increase copra production in the British Solomon Islands through issuance of interest-free loans to assist rehabilitation of plantations.

Several of the British Caribbean possessions have long-time development plans. Jamaica has just inaugurated a 10-year plan, which includes land-settlement proposals, irrigation projects, and subsidies to planters, the whole program being jointly financed by the Colonial and Imperial Governments. Barbados is considering a 10-year plan of a similar nature. The colonial government in British Guiana has a rice-development program, involving about $1,000,000.

Trees in Ecuador

by **ELBERT L. LITTLE, JR.**

Few areas of equal size anywhere in the world probably have as many kinds of native plants as Ecuador. Because of its mountainous topography and limited transportation facilities, until recent years this small country was botanically one of the least known in the Americas.

During the war Ecuador's forests contributed many strategic products [1] to the Allied Nations. When a field party of the United States Forest Service made a preliminary survey of the forest resources of Ecuador in 1943, sponsored by the Office of the Coordinator of Inter-American Affairs, field work was handicapped by the inadequate information available on the native trees.[2] Common names of many commercial timbers had not been correlated botanically with the scientific names. As part of the survey, a collection of herbarium specimens and of wood samples representing the more important tree species was made. The common tree species described in this article, representing only a small fraction of the total number, were selected because of their value for lumber or other products, or because they are otherwise interesting.

[1] WYLIE, KATHRYN H. ECUADOR'S FORESTS AND THE WAR. Foreign Agr. 10: 75–80, illus. 1946.

[2] HORN, EUGENE F. FOREST RESOURCES OF WESTERN ECUADOR. Agr. in the Americas 7: 46–49, illus. 1947.

Mangrove-Swamp Forest

Along the Pacific coast of western Ecuador the mangrove-swamp forest, so widely distributed along silt ocean shores in the Tropics and reaching the United States in southern Florida, is well displayed. Nearly all this forest is composed of a single species of mangrove (*Rhizophora mangle*), known locally as mangle, mangle injerto, and mangle colorado. In northern Esmeraldas and southern Guayas, this widespread species attains optimum development and largest size. It forms a dense forest of large trees up

Mangrove-swamp forest at low tide, showing the numerous branching prop roots which are submerged at high tide. The dugout at lower right shows the water level.

to 125 feet in height and 2 feet, or more, in trunk diameter. Rising from the black muck, the trees have aerial, branching, prop roots 10 to 15 feet high, forming arches in all directions from the trunks. At low tide one can walk and climb over these roots without touching the oozy mud. Most roots are submerged at high tide, when one can travel through channels of water in a dugout or canoe.

Mangrove bark is important for tannin. The wood, which is hard, heavy, strong, and durable, is used for lumber and for ship keels.

Wet Tropical Forest

Most of western Ecuador, including the Pacific coastal plain and the lower slopes of the Andes, has the vegetation of wet tropical forests. This forest type, also known as evergreen seasonal forest, is slightly less humid than the rain forest northward in western Colombia. Though rainfall in this region is high, from about 80 to more than 150 inches annually, there is a long dry season from June to December, when the garua or fog compensates in part for the lack of rain.

Many tree species of various plant families are represented in the wet tropical forest, the composition of which varies from place to place. The larger trees have tall straight trunks, usually with prominent buttresses, and narrow crowns of large thick evergreen leaves that form a dense canopy. They become 100 to 130 feet tall and 1 to 3 feet in diameter at breast height, though a few forest giants grow to 160 feet in height and to 6 feet in diameter. Smaller trees of other species, 15 to 30 feet high, particularly rubiads, melastomes, and pipers, are characteristic of the understory. On the poorly lighted floor of the virgin forest, the herbaceous undergrowth is sparse and open. The trees are well loaded with woody vines, such as aroids and strangling figs, and epiphytes, including ferns, bromeliads, and orchids.

Of all Ecuador's trees, perhaps more has been written about balsa (*Ochroma lagopus*) than of any other.[3] Balsa trees are easily distinguished by the large broad leaves, about a foot long, or on seedlings often more than 2 feet. Among the most rapidly growing trees known, they spring up as weeds do and reach lumber size within less than 10 years. The first year a seedling will elongate more quickly than a corn plant and will reach a greater height. Maximum size is about 100 feet in height and 4 feet in trunk diameter. Balsa has large brownish-green, succulent flowers, about 8 inches in length.

Group of large balsa trees ready for cutting.

The most valuable building material of western Ecuador's wet lowlands is guadua (*Guadua angustifolia*).[4] This bamboo, a giant member of the grass family, reaches 50 feet, or more, in height and has clusters of straight, jointed, green trunks as much as 6 inches in diameter. With their feathery light-green foliage, the trees resemble giant ferns when seen from the air. Groves occur along riverbanks and other low wet places.

Most houses in the rural areas are built principally of guadua. In Ecuador's largest city, Guayaquil, some guadua is used in the construction of most buildings. The hard outer part of the hollow, cylindrical stems is split open into flat, exceedingly durable boards, which are used for walls and flooring of houses and for fences. The stems serve also as poles and scaffolding.

Charles Marie de la Condamine, the first European to become constructively interested in rubber, made his first observations of rubber trees in 1736 in the Ecuadoran Province of Esmeraldas. The native species of rubber or caucho, belonging to the mulberry

[3] BRUSH, W. D. GIFTS OF THE AMERICAS—BALSA. Agr. in the Americas 3:159. 1943.

BANDA C., FRANCISCO. ECUADOR'S BALSA GOES TO WAR. Agr. in the Americas 3:211–213, illus. 1943.

[4] MCCLURE, F. A. BAMBOO IN ECUADOR'S LOWLANDS. Agr. in the Americas 5:190–192, 194, illus. 1945.

Grove of guadua or bamboo along a riverbank in Esmeraldas, with wet tropical forest in background.

family, was not botanically named *Castilla panamensis* until 1903.

Though most rubber has come from commercial plantations of the unrelated Pará rubber tree in the East Indies and elsewhere, Ecuador still produces rubber from wild trees and small plantations and during the war greatly increased its output.

Caucho, a large tree up to 100 feet tall and 1 foot in trunk diameter, is characterized by large hairy, toothed leaves arranged in two drooping rows along nearly horizontal branches. Scars of rubber tapping, consisting of several complete horizontal rings around the trunk, assist identification, since all mature trees near settlements have been worked.

An interesting group of trees in the wet tropical forests belongs to the genus *Ficus*, which includes the cultivated fig and is in the mulberry family also. The native species, called higuerón (meaning large fig) and matapalo (tree killer), have fruits resembling figs but much smaller and inedible. Like the related ornamental India-rubber tree, they have large leathery leaves and white latex. Young plants start as vines from seeds that germinate high up on another tree. These strangling figs send roots down to the ground and around the trunk of the host tree. These rapidly growing roots unite wherever they come in contact and soon surround and choke the host tree until it dies—hence the name matapalo. Then the vine becomes an erect tree with its own trunk.

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A few trees of the genus *Ficus* reach enormous size, 130 feet, or more, in height with trunks 3 to 6 feet in diameter and forming large spreading buttresses as much as 10 to 20 feet in diameter at the ground. The woods are inferior and unimportant commercially.

Sande (*Brosimum utile*) is known also as the cow tree, because its abundant whitish latex may be drunk without injury, although its resemblance to milk relates merely to its color. The wood, which is soft, lightweight, and nondurable, is used for boxes, concrete forms, etc. Majagua or damagua (*Poulsenia armata*), as the scientific name suggests, has twigs that are armed with spines. Though the wood is poor, cloth is made from the fibrous inner bark. Moral fino (*Chlorophora tinctoria*), or fustic, has a strong and durable yellow wood used in construction and, in other countries, as a source of dye.

At one time Ecuador led the world in the production of cacao, the source of chocolate and cocoa. Cacao (*Theobroma cacao*), is a small tree about 15 to 25 feet tall, originally occurring in the shaded understory of wet forests and now grown on large plantations under the shade of taller trees. Though cacao of high quality still is an important export crop, production has declined, partly as a result of disease.

Palms of various species are scattered through the wet tropical forests and in some places are rather conspicuous. The largest is palma real (*Ynesa colenda*), a Spanish name meaning royal palm and applied improperly to this and other large palms distinct from the true royal palm. This giant tree, widely distributed across western Ecuador, is 60 to 100 feet tall, with a large stout trunk 1.5 feet in diameter, and has oil-bearing seeds.

Another beautiful palm, pambil (*Iriartea* sp.), has a slender graceful trunk up to 80 feet high and less than a foot in diameter. Groups of these trees are

Base of giant matapalo tree about 135 feet tall.

especially noticeable where they have been left in clearings. The durable slabs from the trunks are important for flooring.

Western Ecuador is the home of ivorypalms from which vegetable ivory is obtained. Known as tagua or cadi (*Phytelephas aequatorialis*),[5] this small tree, about 20 feet high and with a stout trunk, occurs in the forest undergrowth, in clearings, and on plantations, chiefly in Manabí and Esmeraldas. From the very hard white endosperm of the nut or seed buttons are made, and novelties for the tourist trade are carved. In value tagua nuts have been one of the more important exported forest products.

Although neither a tree nor a palm, the Panama-hat palm or toquilla (*Carludovica palmata*)[6] deserves mention in any discussion of Ecuador's forests. This trunkless, palmlike plant of the cyclanthus family, with large long-stalked leaves 6 to 10 feet high, resembling a fan palm, occurs throughout the humid lowlands of tropical America.

The best represented genus of the legume family in the wet tropical forest is *Inga*, known by the common name of guavo or guava. These medium-sized trees with pinnately compound leaves, feathery white flowers, and large beanlike pods are planted as shade trees for cacao. The whitish well-flavored pulp around the seeds is edible. Palo prieto (*Erythrina glauca*), also called madre de cacao (mother of the cacao tree) because of its use for shade, is a large spreading leguminous tree with red-tipped orange flowers. Nato (*Mora megistosperma*) is noted for its enormous seeds up to 7 inches long, borne in conspicuous beanlike pods as much as 10 inches long. The wood, which is hard, heavy, strong, and durable, is used for many types of construction.

Of the mahogany family, cedro or Spanish cedar (*Cedrela fissilis* and other species), an important lumber tree of tropical America, grows in lowland forests, especially in flood plains. The large trees reach 125 feet, or more, in height and 3 feet, or more, in trunk diameter. The reddish-brown wood is light in weight, easily worked, and durable. It is used for furniture, interior finish, and cabinet work, as well as for general construction. Tangare (*Carapa guianensis*), also called figueroa, is another large tree of the same family with wood of similar uses.

Dry Tropical Forest

Parts of southwestern Ecuador near the Pacific coast, chiefly in the Provinces of Manabí, Guayas, and El Oro, have a dry climate, with a rainless season from June to December, and the vegetation is that of a dry tropical forest or a deciduous seasonal forest. This forest type, though cut-over in many places for construction timbers, may be observed near Guayaquil. The small, or average, spreading trees, 25 to 60 feet high and 10 to 20 inches in trunk diameter, shed their small, or medium-sized, leaves in the early part of the dry season, when they produce flowers.

Palma real, Ecuador's largest native palm, has oil-bearing seeds of commercial value.

One plant family, the legume, is predominant in the dry forest. Leguminous trees are generally small and spreading, often with spiny branches, and they have small pinnately compound, deciduous leaves and beanlike pods. The woods from them are typically hard, dense, and durable. Algarrobo (*Prosopis inermis*), a close relative of the mesquite of southwestern United States, is common on grassy plains or savannas, such those near Guayaquil. Several kinds of acacia, such as faique (*Acacia macracantha*), are present as small spreading trees or large shrubs, usually spiny.

One of the largest legumes in the dry forest is guachapelí (*Pseudosamanea guachapele*). This spreading tree, up to 80 feet tall, is often planted outside the dry zone, sometimes for shade on coffee plantations. The very durable wood is used especially in shipbuilding and for railway ties. The heaviest wood found during the field studies in Ecuador was that of cascol (*Libidibia corymbosa*), a spreading tree with bark which

[5] SCHREIBER, WALTER R. TAGUA. Agr. in the Americas 6:51–53, 58, illus. 1946.

[6] DU FRANE, BEATRICE. ECUADOR'S PANAMA HAT INDUSTRY. Agr. in the Americas 5:67–69, 75, illus. 1945.

peels off much as that of a sycamore. The strong, hard, durable wood weighs as much as 80 pounds a cubic foot. Seca (*Geoffroea spinosa*), a legume with a one-seeded fruit resembling a small dried peach, is common locally in various areas. Its medium-to-heavy wood is used for furniture and small wooden articles.

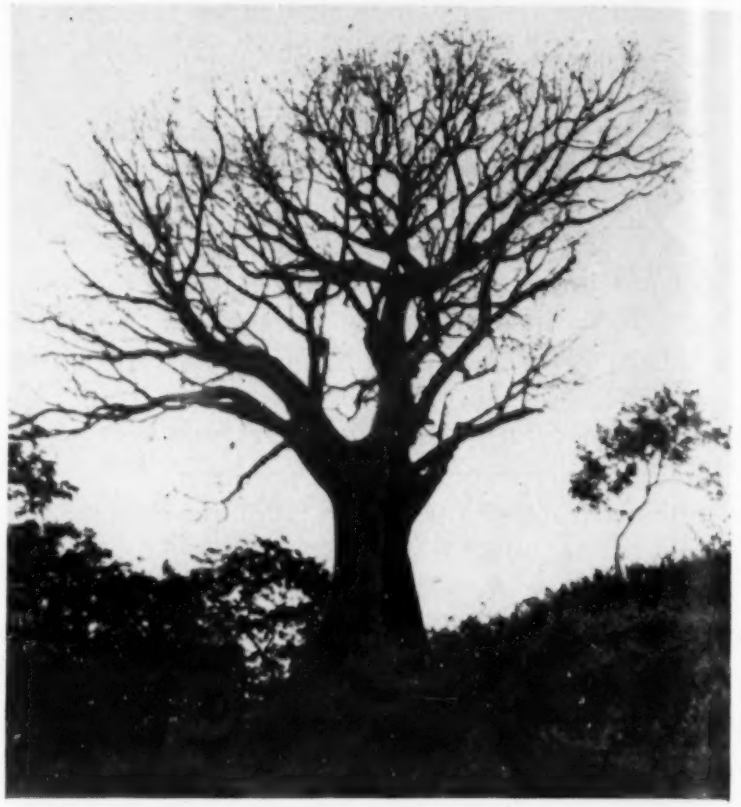
Guayacán is a characteristic tree species of the dry forest. Its scientific name, *Tabebuia chrysantha*, refers to the clusters of large tubular golden-yellow flowers that are especially conspicuous, borne on leafless branches, during the dry season. The dark, dense, hard, durable wood, resistant both to termites and to marine borers, is used for railroad ties, shipbuilding, and posts. Bototi llo (*Cochlospermum vitifolium*) bears large yellow flowers also when without leaves, but its soft, light, nondurable wood is not used.

The giants of the dry forest, ceibos or ceibas, are members of the bombax family. This family is noted for soft nondurable woods, which with the exception of balsa are seldom used commercially. Because of the valueless wood and the large size of the trunks, these trees naturally are left standing when the forest is cut over or cleared. One species of ceibo (*Ceiba trischistandra*) in the Guayaquil area, usually less than 65 feet in height, has enormous trunks 3 to 5 feet, or more, in diameter, frequently swollen some distance above the stout buttresses at the base.

Ceibo trees (*Ceiba pentandra* and related species), natives of the American tropics, are the source of the vegetable fiber kapok, which consists of the soft fluffy hairs borne in the seed pods. Besides its use in mattresses and upholstery, kapok, because of its buoyancy, was a high-priority war material employed in life jackets, pontoons, and buoys. It was also used as an insulating material for lining sleeping bags. Western Ecuador, with its wild kapok trees, became a leader in the production of this essential fiber when commercial production from the Netherlands East Indies was cut off during the war.

Wet Temperate Forest

At higher elevations on the western slopes of the Andes the climate of Ecuador becomes cooler and more temperate, the trees are smaller, and the forest composition changes. This Temperate Zone vegetation above an elevation of about 6,500 feet may be designated as a wet temperate forest or a temperate rain forest. The trees, which are broad-leaved evergreens, generally are about 60 feet tall and 2 feet, or less, in trunk diameter, although a few forest giants become 100 feet tall and 3 feet in diameter.



This giant ceibo tree, with smooth greenish trunk and branches, has shed its foliage in the dry season.

From the bark of cinchona trees (*Cinchona pitayensis*, *C. officinalis*, and *C. pubescens*), Ecuador's greatest contribution to mankind was obtained—quinine.[7] Known locally as cascarilla or quina, cinchona is the national plant of Ecuador. The trees are generally small, less than 50 feet high and 8 inches in trunk diameter, growing in the shade of larger trees at elevations usually between 5,000 and 10,000 feet. During the late war, when the supply of quinine from the Dutch plantations in Java was curtailed, Ecuador made an essential contribution to the war effort through the harvest of wild-cinchona bark.

Various useful timbers are also found among the many tree species of the wet temperate forest. The Spanish cedar or cedro (*Cedrela rosei*), a different species from that of the lowlands, is a large tree with a similar valuable wood. A characteristic, average-sized tree with durable wood is guasipata or encinillo (*Weinmannia descendens*). Species of the laurel family known as canelo and jigua (*Nectandra*, *Ocotea*, and related genera), are well distributed in both the temperate and tropical zones. They have valuable woods, generally of medium weight, strong, and fairly durable, which are used for furniture, cabinet work, and construction.

Scattered in this forest occurs Ecuador's only native

[7] POPENOE, WILSON. QUININE FROM THE "FEVER TREE." Agr. in the Americas 2:43–47, illus. 1942.

conifer, sisín (*Podocarpus* sp.). The soft clear wood is used for carpentry, cabinet making, and carving. Tree ferns (species of *Cyathea* and *Alsophila*) have their greatest display in this zone, although some are found also in the lowland forests. They are small trees of the understory, with straight unbranched trunks 10 to 20 feet high, bearing a terminal cluster of giant dissected fronds 5 feet, or more, in length.

Even the tropical Andes have a timber line above which tree growth is absent because of continued cold weather at high altitudes. More surprising is the fact that the timber line here on the Equator is at about an 11,000-foot elevation, no higher than that in the southern Rocky Mountains of western United States. At the upper limit of forests the trees are only 15 to 30 feet tall. Characteristic species are: Aliso (*Alnus jorullensis*), which is botanically an alder; mandur (*Clusia* sp.); and encinillo (*Weinmannia descendens*). Aliso is planted about farms in the Sierra, where its reddish wood is used in carpentry, furniture making, and cabinet work. A few small trees occur above the timber line, rarely up to 13,000 feet in elevation, in the paramillo vegetation of evergreen small-leaved shrubs 6 to 10 feet high.

Unforested Sierra

Visitors to Quito in Ecuador's unforested Sierra, or central mountainous region, are impressed with the prominence of a single tree species—the Tasmanian blue eucalyptus or blue gum, known in Spanish as eucalipto (*Eucalyptus globulus*). Introduced in 1865 from Tasmania, Australia, this tree has become thoroughly adapted in plantations on the densely populated Andean highlands or plateaus, where the native vegetation, including the original forests, was removed long ago.

Eucalyptus plantation at Quito in the Sierra. Sprouts composing the stand came up from stumps after the first cutting.

Eucalipto is a tall tree 50 to 100 feet, or more, in height, with straight trunk 1 to 5 feet in diameter, and with a narrow crown. One giant individual in Ambato, said to be the oldest in the country, has a trunk 8 feet in diameter. Young trees have broad bluish leaves, whereas the mature trees have narrow green leaves. Rapid growth and ease of propagation by sprouts from the cut stumps are among the desirable qualities. Although the primary value is for fuel, in the absence of better woods, the wood is widely used for general construction. Medicinal oil is extracted from the leaves.

Capulin cherry or capulí (*Prunus serotina* var. *salicifolia*), originally described from Ecuador, was introduced from Mexico after the Spanish conquest and now is thoroughly naturalized and widely distributed in the Andes. It is a medium-sized tree 35 feet tall and 1 foot in trunk diameter, with edible cherry fruits. The wood, similar to that of other cherries, is used especially for cabinet work and furniture.

Nogal or tocte (*Juglans neotropica*), a native Andean walnut resembling black walnut, is another tree species prized for both its fruit and wood. It is medium-sized, about 50 feet in height and 1 foot in trunk diameter. The wood, which is brown, light and soft, fairly strong and durable, is valued chiefly for furniture and cabinet work. This species, which grows well in plantations around towns, might well be used to a greater extent in reforestation.

Reading about... Foreign Agriculture

The Fresh-Vegetable Industry of Mexico and the United States—A Review of Wartime Developments, a report of the Mexican-United States Agricultural Commission, I. A. C. Series, No. 5, OFAR, USDA. 25 pp., illus., Washington, D. C., December 1947. This study is one of a series initiated at the first meeting of the Mexican-United States Agricultural Commission in Mexico City, July 1944. As the title indicates, the situation with regard to the principal fresh vegetables grown in Mexico and the United States is reviewed, with particular attention to marketing problems and competition in the United States and Canada and the effects of the recent war on the industry as a whole.

Where Lack of Fuel Means Food Shortage

Speaking not too figuratively, Greek farmers must "rob the pantry to feed the fire." Wood scarcity forces them to burn manure and straw, thus impoverishing their soil. Use of lignite coal might help solve a basic problem.

by C. S. STEPHANIDES

There has been much talk of the need for coal to make fertilizer in the nitrogen plants of Europe in order to restore soil fertility and increase food supply. There has been, however, little study of another fuel-food supply relationship; that is, the problem of rural household fuel as it relates to maintaining soil productivity in such areas as the Greek plains. These are representative of similar areas in many other, older parts of the world.

The history in all such areas is about the same. Continuous cutting of forests depletes the wood supply. But farmers and villagers need fuel to warm their homes, bake their bread, cook their food, do their laundry. So manure—the most valuable available source of plant food and organic matter to maintain the soil—is burned, along with crop residues, such as straw, which are valuable for the same purpose. Soil productivity declines; poverty and hunger grow.

The bread-grain-producing areas in Greece, largely on the plains, are not extensive. Here the farmer's income is too small to permit him to buy wood or other fuel. From villages on the plains of Thrace, Thessaly, and Macedonia, the farmers must go 30 to 45 miles to get a wagonload—less than a ton—of wood.

Under these conditions, the custom of utilizing farm manure for fuel has become firmly established. Investigations have already proved that the productivity of the fields is progressively reduced. Rotation of crops, new varieties of seed, not even application of chemical fertilizers can offset the loss of manure as a soil builder. Furthermore, as the remote woodlands are depleted the problem becomes more acute. A not-unusual experience is to find farmers burning all their manure and part of their straw.

The roads leading to the forests are steep, rough, and difficult for any modern vehicle. Wagons can be taken only to a certain point; beyond this, the farmer has to carry the wood for a considerable distance. The damage to wagons and injury and exhaustion of animals, averaging $3.50 per farmer, is excessive to a family whose income is less than $300 per year.

Restrictions of the Forestry Department permit one to gather only dead wood or decayed stumps. The scarcity of such material, however, obliges farmers to cut down green trees despite fines of 33 cents to $5.30—sometimes repeated—for illegal cuttings which also are a burden to poor farmers. Both excessive cutting of trees and burning of manure and straw for domestic fuel at the cost of soil fertility are destructive from the standpoint of the national economy.

An intensive study was made among 89 farmers in the village of Megali Vrisi, on the plain of Krystonos, which is more or less typical of all the villages in this area. The villagers use wood, manure, straw, brush, and charcoal as domestic fuel.

Priest carrying wood to the monastery of St. John, Serres.

Dr. C. S. Stephanides, Regional Specialist, Technical Collaboration Branch, OFAR, served as extension agent in Macedonia, Greece, from 1932 to 1940, during which time he made a study of the fuel problem in the Kilkis area.

This article was made possible by funds provided through the U. S. Interdepartmental Committee on Scientific and Cultural Cooperation.

All the families had some livestock, averaging three to four large animals, such as cows or water buffaloes, and about as many small animals, such as sheep, goats, and hogs. Manure production averaged about 34 wagonloads, of which quantity, on the average, about four-sevenths was burned. Only 61 farmers applied manure to their fields; 70 farmers burned it. The 61 using manure as fertilizer applied an annual average of about 22 wagonloads which covered about 1.5 stremmas (about one-third acre) of land.

The average landholding in this particular area was about 45 stremmas (10 acres) in size, which is larger than for Greece as a whole. At this rate, 30 years would be required to give all the land of the average farm one application of manure. If all the manure burned had been used instead as fertilizer, about twice as much land could have been manured each year.

In addition to fresh manure, which is especially prepared at home by mixing it with finely cut straw, cutting the mixture into brickettes, and stacking them to dry, large amounts of cow droppings are collected from the pastures.

Manure is used both for cooking and heating, but wood or brush is essential for bread baking because of the construction of the ovens. As a rule each farmer has his own oven, built out of doors of clay and stone. It is dome-shaped, with a flat slate floor, the door opening serving as a chimney. The amount of wood used in bread baking could be reduced considerably if the community or the local cooperative would build two or three more efficient ovens for the use of the village.

Despite the inadequate supply, about 90 percent of the farmers used wood as fuel, ranging from 1 to 15 wagonloads, in gathering which the average farmer spent 23 days. Only about 12 percent of the farmers bought wood.

In this cereal-growing region, straw is plentiful, and there is always a good market for it, mainly for use as animal feed. Because of fuel shortage, however, the farmers can afford to sell only a very small portion of their straw, since they use it as fuel for cooking and heating. On the average each farmer uses a little over 2 tons of straw for fuel each year.

Another fuel used in this region is briar (*Rubus fracticocus* var.). A little charcoal was being burned when this study was made but only by the local dressmaker to heat pressing irons. Charcoal is not used in the villages as it is in the cities.

As the forests grow scarcer, and the forest laws become more severe, the heavier will be the use of manure for fuel. Permanent agricultural improvement will be difficult or impossible unless the fuel problem of these areas is solved. The costly commercial fertilizers are not fully effective in improving the fertility of soils, which are very low in organic matter. The farmers cannot increase the organic material in their soils unless the manure is returned to the fields.

Fuel shortage results in such soil erosion.

The cheapest method of meeting the fuel problem of these Greek areas is by the extensive introduction of lignite coal. In other parts of the world facing the same problems other and cheaper fuels may be found. The use of lignite coal raises the problem of finding a suitable means for burning it, because lignite coal cannot be utilized in stoves that are adapted to other fuels, such as hard coal. The stove should serve the dual purpose of heating and cooking on the farm.

The designing of a cheap and simple lignite-coal-burning stove for the Greek farmer and villager may seem a remote approach to the problems of forestry, soil conservation, flood control, restoration of soil fertility, and better food for the Greek people.

Nevertheless, the inventor who designs such a stove might do more for the reforestation of Greece, the improvement of the agriculture of the Greek plains areas, and the Greek food supply than one could do by passing volumes of reforestation laws and setting up many soil-conservation schemes.

Lignite coal is abundant in both northern and southern Greece, and mining facilities could be improved and increased. The Agricultural Bank, with the cooperatives in the areas where lignite can be used, might be able to reduce the handling costs by arranging for large shipments of lignite coal during the months when the national railroads are not too busy with other freight. Some further impetus might be given by adjustment of taxes to encourage the use of lignite coal by farmers.

The Greek Government understands the seriousness of the problem and its effect upon agricultural production. The American Aid Mission also is investigating the greater use of lignite coal, particularly as a source of hydrogen in the manufacture of chemical nitrogen fertilizer.

LONCHOCARPUS—A SOURCE OF ROTENONE

Commercial rotenone root, a potent insecticide that is nonpoisonous to man, is largely obtained from two legumes, lonchocarpus and derris. Lonchocarpus, a native of the American tropics, became during the recent war the principal source of rotenone, because roots from derris, which grows almost entirely in the Far East, could not reach foreign markets. Lonchocarpus, the roots of which have long been used by the Indians of tropical America to stun the fish they catch for food, is often called "barbasco," a term applied by Spanish-speaking people to all fish poisons. The plant is also known by various other names, such as cube in Peru and timbó in Brazil.

During early growth, lonchocarpus is bushlike in form, but later it resembles a vine, often climbing to the tops of tall trees or trailing along the ground. It thrives in a tropical climate at low altitudes and must have not less than 80 inches of rainfall per year on well-drained soil. At time of harvest, the top growth is cut away; the roots, after removal from the soil, are dried in the sun or in drying chambers, tied into bundles, and shipped to the consuming country for processing. There the roots are ground into powder, which is mixed with a diluent, such as talc, for dusting or is added to a liquid for spraying.

Before the war the United States utilized from 50 to 70 percent of the world's commercial production of rotenone-bearing roots. Yearly imports into this country during 1938–40 averaged 4 million pounds, less than half of which amount comprised roots from lonchocarpus. By 1946, however, imports of rotenone-bearing roots from the other Americas totaled more than 11 million pounds, almost 96 percent of which originated in Peru, the principal commercial producer of lonchocarpus.

In spite of competition from the synthetic insecticides, such as DDT, rotenone is ideal for use on crop plants, because it leaves no poisonous residue. It is also useful in combatting certain parasites that infest animals.

INTERNATIONAL *Agricultural News*

International Collaboration in Agriculture Expanded

Expansion of the United States program of international collaboration in agriculture from hemispheric to global proportions has been legislatively authorized.

The U. S. Department of Agriculture, primarily through the Office of Foreign Agricultural Relations, the Bureau of Plant Industry, Soils and Agricultural Engineering, and other agencies, for a number of years has been cooperating with the governments of the other American Republics in scientific and technical programs designed to increase agricultural efficiency, improve living levels, and promote postwar international prosperity.

Public Law 402 of the Eightieth Congress, approved by President Truman, January 27, 1948, now provides statutory authorization for such cooperation with the governments of countries outside the Western Hemisphere, and comprehensive plans have been drafted for broadening United States leadership in the field of international collaboration in agriculture under the new act.

These plans, calling for achievement of greater efficiency in the field of agriculture through increased application of science, technology, and improved methods and materials, are based upon the principle that United States "export" of "know how"—a commodity renewed and enriched by use—will enable other countries of the world to become more active in international exchange of products.

It has been pointed out that such exportation will not reduce this country's wealth or resources but, on the contrary, will increase the knowledge of United States technicians and will increase the supply to United States farmers of propagating materials and agricultural practices from abroad.

The expanded collaboration program, following practice established in the United States program of agricultural cooperation in the Western Hemisphere, will be implemented through operating agreements with the governments of foreign countries, providing

for the establishment of agricultural stations and the assignment of United States experts to advise officials of the foreign governments in agricultural matters. Under the agreements, the United States will supply technical equipment and personnel. The foreign governments will provide land, buildings, operating facilities, skilled and unskilled labor, and local technicians to work with United States experts.

United States cooperation in agriculture with countries outside the Western Hemisphere heretofore has consisted chiefly of sending technical missions to such countries, when invited to do so, to assist local officials in formulating plans for agricultural improvement. Such missions visited the Middle East, China, and the Philippines in 1946. This new authority will permit the United States to cooperate with the other countries in the implementation of the recommendations of these missions.

As plans and conditions develop sufficiently to permit effective action, it is proposed to carry out active collaboration programs in an east-west belt, including the Mediterranean Basin, the Arabic countries and Liberia, southern Asia, China, the Philippine Islands, and the non-self-governing islands of the Pacific.

Cooperative Campaign To Control Locusts

An outstanding development in Central American agriculture during recent months has resulted from a cooperative endeavor to control locusts by the most modern methods. For years one, or more, of the Central American Republics has been confronted by locust plagues which have caused considerable damage to crops. With little or no organization, these countries have heretofore relied upon rather primitive means of control, which usually have not been satisfactory.

At the Third Inter-American Conference on Agriculture, held in Caracas, Venezuela, in 1945, in Resolution XXVIII, entitled "Cooperation in the Prevention of and Fight Against Agricultural Diseases and Pests," it was resolved that "the important migratory plagues that may be controlled in the country of their origin be investigated and effective measures be taken to fight them through international cooperation." Fully realizing the need for more concerted action, the Government of El Salvador took the initiative and called a Conference of the Ministers of Agriculture for the organization of an administrative technical entity which will be in charge of the control of plagues, such as locust swarms and hoof-and-mouth disease. At the Conference, held in San Salvador last February, an agreement was signed for the establishment of the "Institute of Plant and Animal Sanitation for Central America and Mexico."

Although final action by the legislative bodies of the signatory countries toward the ratification of the resolutions of the Conference has not been completed, the Governments of El Salvador, Guatemala, and Mexico have been cooperatively engaged in locust-control operations since last May. The scene of more intensive activity has been in El Salvador, where the United States Department of Agriculture has cooperated by giving advice and assistance through the assignment at various intervals to El Salvador and other Central American countries of Edson J. Hambleton, Entomologist of the Office of Foreign Agricultural Relations.

Following several large invasions of locusts into El Salvador from nearby republics, authorities in that country soon switched from the small, impractical flame thrower to airplane control. Benzine-hexachloride dust was flown from the United States to El Salvador for use in poisoning the locusts. Several hundred tons of this insecticide have been used in applications made by plane, hand, and power-dusting equipment since last June. Similar control methods have been practiced in the parts of Guatemala that were also invaded by swarms of locusts.

The initiative taken by the various republics engaged in the Central American locust-control program represents a significant step in their agricultural development. This season's results have been most promising. Despite organizational difficulties and lack of experienced technical assistance, comparatively little loss has been occasioned by locusts in either El Salvador or Guatemala.

Bolivia Fights Greatest Locust Plague in History

Since last October, when invading hordes of the migratory locust swept into southern and central Bolivia, the country has been faced with as serious an insect problem as it has ever had to contend with. Although the locusts are believed to be largely concentrated in the uninhabited and uncultivated areas of the Bolivian chaco and of Santa Cruz, where no appreciable loss to the nation's economy can occur, cultivated valley areas in the Departments of Cochabamba, Potosí, Sucre, and Tarija have suffered serious damage to crops of corn, potatoes, and rice.

Dispatches from La Paz state that in the barren highlands of Potosí, the locusts are reported to have reached altitudes of 15,000 feet, a record believed to be the highest in the history of the species. Although serious damage has been caused to crops in the infested areas, it is yet too early to estimate the extent of the loss or its possible effect on the country's food situation.

The Government of Argentina, living up to an International Agreement of experts in the fight against locusts, concluded in September 1946 between the Governments of Bolivia, Paraguay, Argentina, Uruguay, and Brazil, has been of potential aid to Bolivia in its present difficulty. Assistance has been rendered in the training of Bolivian personnel and in the acquisition of supplies and equipment from Argentina.

The Bolivian Government has made available approximately $100,000 to its Ministry of Agriculture for conducting the locust campaign. An all-out effort is being made by every conceivable means, including the use of poison baits with new insecticides to combat the first generation of young locusts hatched in Bolivian territory. Unless more funds are forthcoming, it is believed that a large part of the 1947–48 crop production is in imminent danger of being lost.

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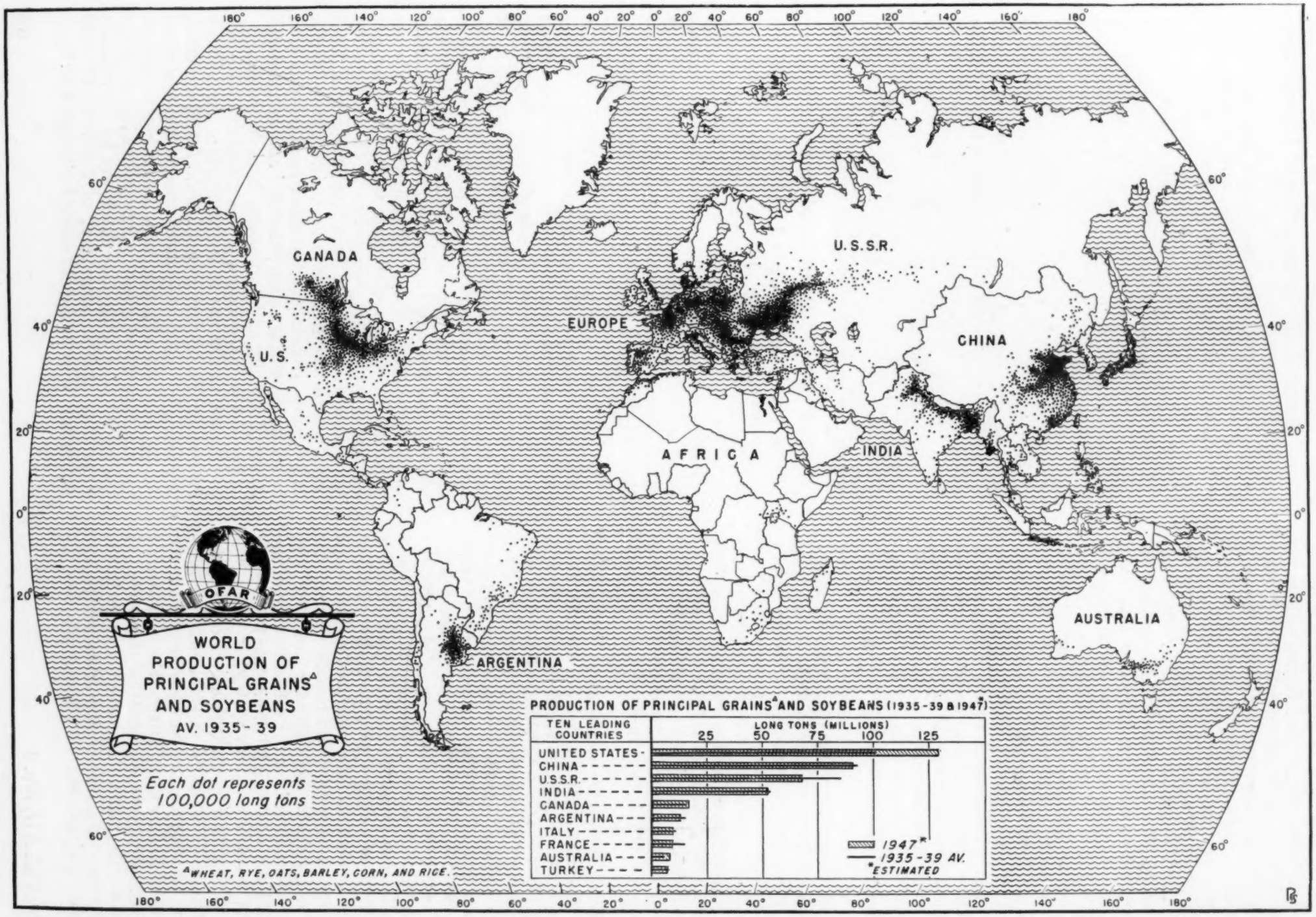

The combined food pattern of the principal grains and soybeans shown above becomes more significant when compared with the population pattern of the map in the January issue. Of the 10 principal countries producing these grains and soybeans, shown in the chart, only the United States had heavy increases. Australia and Canada produced slightly larger crops in 1947 than in the prewar period 1935–39. The total world production in 1947 was estimated at 564 million long tons as compared with 597 million in the prewar period. The heavy decreases occurred mainly in the western European countries and the Far East.